

Application Number 10/823,483
Amendment dated July 12, 2007
Response to Office Action mailed May 15, 2007

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Remarks/Arguments

Claims 1 – 14 are pending in the application. Claims 1 – 7 stand rejected under 35 USC 103(a) as being unpatentable over Shakouri and Fitzpatrick; claims 8 and 9 stand rejected as being unpatentable over Shakouri, Fitzpatrick and Richards; claims 10 – 14 stand rejected as being unpatentable over Shakouri, Fitzpatrick and Huffman. Applicant respectfully traverses Examiner's rejection of the claims for the reasons set out below.

Detailed Action Item 3

Examiner has found Applicant's arguments concerning the spacing of the electrodes traversing the rejection of claims 1 – 7 as being unpatentable over Shakouri and Fitzpatrick under 35 USC 103(a) to be not persuasive because the spacing of the electrodes is not a limitation of claim 1.

Examiner has also found Applicant's argument that Shakouri teaches away from the operating range of inter-electrode spacings taught by Fitzpatrick, thereby traversing the rejection of claims 1 – 7 as being unpatentable over Shakouri and Fitzpatrick under 35 USC 103(a) to be not persuasive because the spacing of the electrodes is not a limitation of claim 1.

Applicant has amended claim 1 accordingly, to included the limitation of claim 11, namely that the collector and emitter electrodes are placed to within 200 angstroms of each other.

Applicant believes claims 2 – 7 and 10 to be patentable, if only because of their dependence on claim 1.

Detailed Action Item 2

Applicant believes claims 8 and 9 to be patentable, if only because of their dependence on claim 1.

Detailed Action Item 3

Examiner considers the limitation in claim 11 of placing the electrodes to within 200 angstroms of each other to be properly rejected over Huffman.

Huffman does say that "Qualitatively, the TTC measurements are in agreement with expectations based on the theoretical model and extrapolated Stage-5 K-GIC data" (see the DISCUSSION

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section, page 579), but he goes on to say that "Quantitatively, the TTC results are significantly lower than expected".

Whilst it is true, then, that "Huffman teaches the closing spaced electrodes causes a qualitative increase in the operation of thermionic devices, such as 10 angstroms", Applicant does not believe that this is an accurate summary of the teaching of Huffman, as it ignores the quantitative data that belies the supposition of the qualitative.

Drawing Examiner's attention to an earlier section of the paper, in Figure 8, Huffman has shown a Figure of Merit performance curve based on extrapolations, which show that at 900K (the operating temperature of his experimental device), the Figure of Merit is about 10^{-2} , which is about an order of magnitude better than conventional thermoelectric devices. However, the experimental data were some 200-fold lower than expected (see the DISCUSSION section); in other words the Figure of Merit was more like 5×10^{-5} , which is more than an order of magnitude lower than conventional thermoelectric devices.

Thus the teaching of Huffman's experimental investigation is that there is not a quantitative increase in the performance of the device when electrodes are spaced to with 10 angstroms.

There cannot therefore have been any reason for a person of ordinary skill in the art at the time of the invention to construct the heat pump of Shakouri and Fitzpatrick with the spacing of 10 angstroms causing tunneling to improve the qualitative operation of the device, as Huffman fairly clearly indicates that it wouldn't.

It is worth noting that Huffman's device comprises a 6mm thick disk of ZYH HOPG sandwiched between two tungsten electrodes (page 578); on start-up this construct is exposed to cesium vapor which leads to the formation of the cesium intercalated HOPG having a thickness of some 12mm.

The distance between the electrodes in the device of Huffman is thus 12 mm, rather than 10 angstrom. 10 Angstrom is the distance between the planes of graphite in the cesium-intercalated HOPG material.

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Applicant believes claims 12 – 14 to be patentable, if only because of their dependence on claim 1.

Applicant respectfully submits that this application is in condition for allowance, and such disposition is earnestly solicited. If the Examiner believes that discussing the application with the Applicant over the telephone might advance prosecution, Applicant would welcome the opportunity to do so.

Applicant is making this reply within two months of the mailing date of the final action so that if the Advisory Action is not mailed until after the end of the three-month shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee required to be paid pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action.

Respectfully submitted,



Avto TAVKHELIDZE
Inventor